



HEARTSTART XL

USER TRAINING WORKBOOK

User Training Workbook

M4735A HeartStart XL

Notice

About This Edition

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Medical Device Directive

The M4735A HeartStart XL Defibrillator/Monitor complies with the requirements of the Medical Device Directive

93/42/EEC and carries the ₀₁₂₃ mark accordingly.

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Warning

Radio frequency (RF) interference from nearby transmitting devices may degrade the performance of the M4735A HeartStart XL Defibrillator/Monitor. Electromagnetic compatibility with surrounding devices should be assessed prior to using the defibrillator/monitor.

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Lesson 1: Introduction

Lesson Objectives

Upon completion of this lesson, you should be able to:

- Determine if this workbook is for you
- Know how to use this workbook
- Know what you can expect from this workbook

Lesson Topics

- Workbook Prerequisites
- How to Use This Workbook
- What You Can Expect to Learn

Workbook Prerequisites

To gain the most from this workbook, you should:

- Be a certified BLS or ALS provider
- Have access to a M4735A HeartStart XL Defibrillator/Monitor

How to Use This Workbook

You may choose to review all of the material in this workbook. Or you may choose to review only individual sections of this workbook as it relates to your training needs.

Material is divided into Lessons, Topics, Summaries, and Reviews.

Lessons

Lessons provide you with learning objectives, information relating to a specific feature or function of the defibrillator/monitor, and an opportunity to test your knowledge on the information presented.

Topics

Topics address a particular aspect of a lesson.

Summary

Summaries provide a brief synopsis of the information presented in the lesson.

Review

Reviews act as a self-check at the end of a topic, giving you the opportunity to check your understanding of the information covered throughout the lesson. (Answers are provided at the back of the book.)

What You Can Expect to Learn

Upon completion of this workbook, you should be able to:

- Identify the functions and features of the HeartStart XL, including SMART Biphasic Waveform Technology
- Identify the HeartStart XL controls
- Identify steps for AED Mode defibrillation
- Define Easy 1-2-3 method for Manual Mode defibrillation
- Identify elements of ECG Monitoring display
- Identify elements of SpO2 Monitoring display
- Identify and interpret Event Summary and strip documentation
- Perform a Shift/System Check
- Identify key maintenance practices to ensure proper functioning of the HeartStart XL and its batteries

Lesson 2: Getting Started

Lesson Objectives

After completing this lesson, you should be able to:

- Define the main features and functions of the HeartStart XL
- Identify SMART Biphasic Waveform Technology
- Identify the HeartStart XL controls and display elements

Lesson Topics

- Introducing the HeartStart XL
- Understanding the SMART Biphasic Waveform Technology

Lesson Overview

This lesson will introduce you to the features and functions of your HeartStart XL. You will also be introduced to the benefits of using SMART Biphasic Waveform Technology.

Introducing the HeartStart XL

The M4735A HeartStart XL Defibrillator/Monitor is a lightweight, portable, semi-automated external defibrillator. It offers two modes of operation: AED Mode and Manual Mode.

Figure 2-1 HeartStart XL (front view)

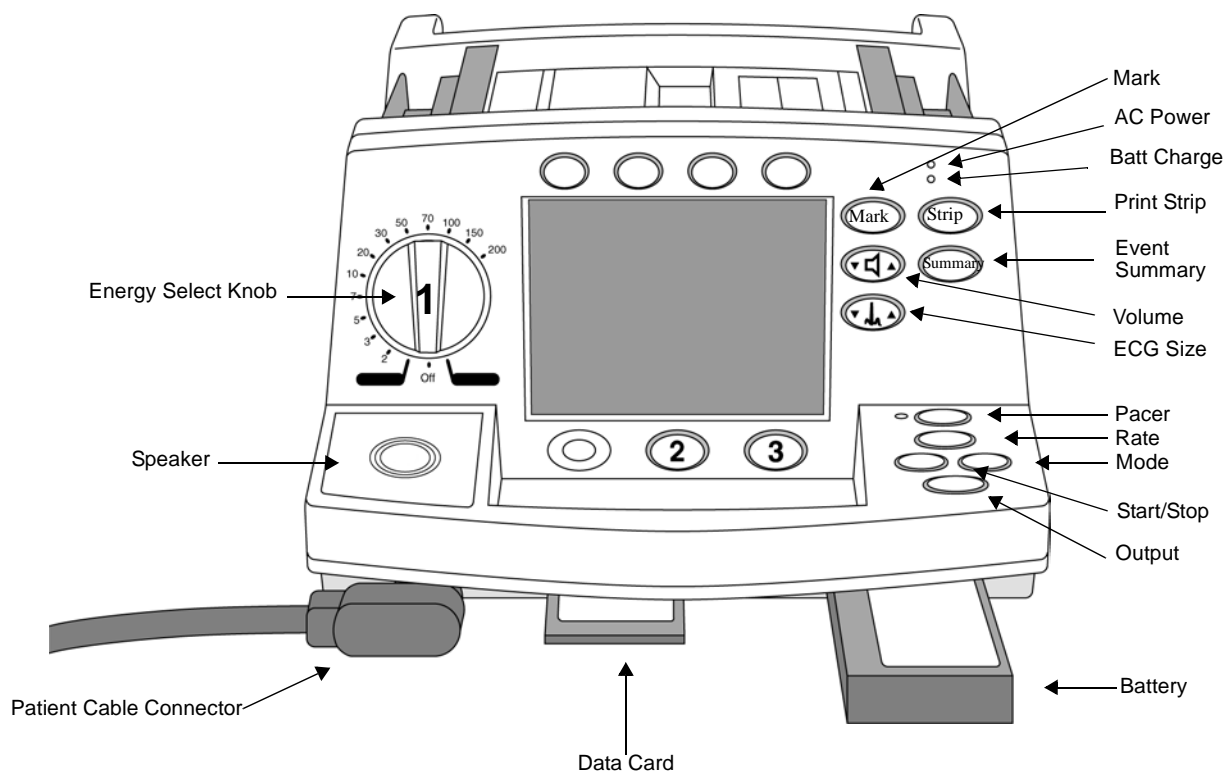
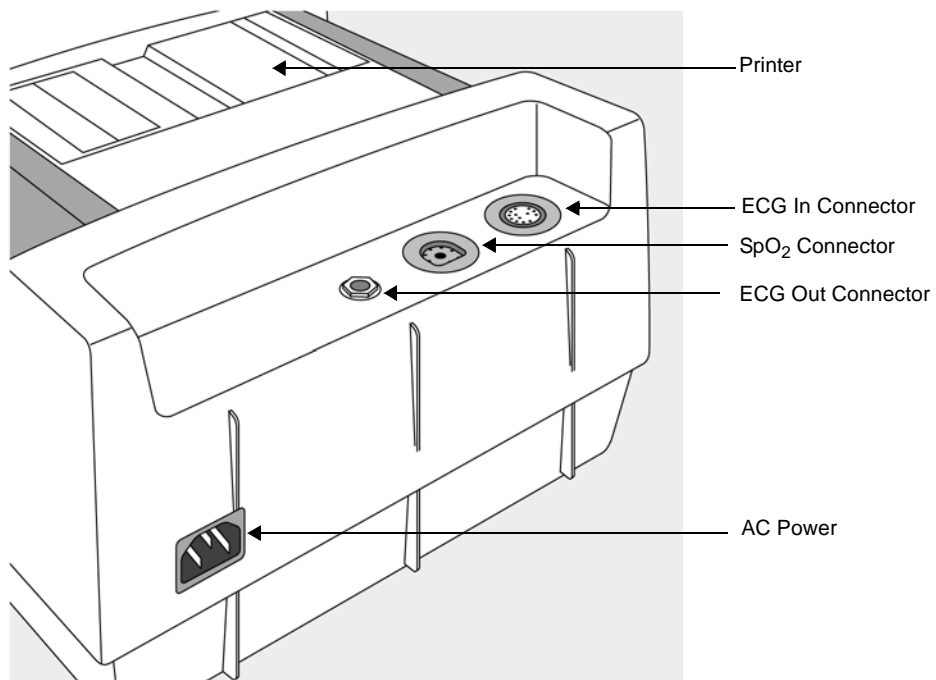


Figure 2-2 HeartStart XL (back view)



AED Mode

In AED Mode, the M4735A HeartStart XL Defibrillator/Monitor analyzes the patient's ECG and advises you whether or not to deliver a shock.

Voice prompts guide you through the defibrillation process by providing instructions and patient information. Voice prompts are reinforced by messages that appear on the display.

In AED Mode, 3 lead or 5 lead ECG monitoring electrodes can also be used to monitor a patient's ECG.

Manual Mode

Manual Mode is designed for providers who are certified ALS providers. When using Manual Mode, the HeartStart XL turns control of the defibrillation process over to you.

While the defibrillator/monitor analyzes the waveform, you assess the patient's ECG and select the appropriate level of energy for defibrillation, if necessary. You also have the ability to perform synchronized cardioversion and noninvasive pacing (optional).

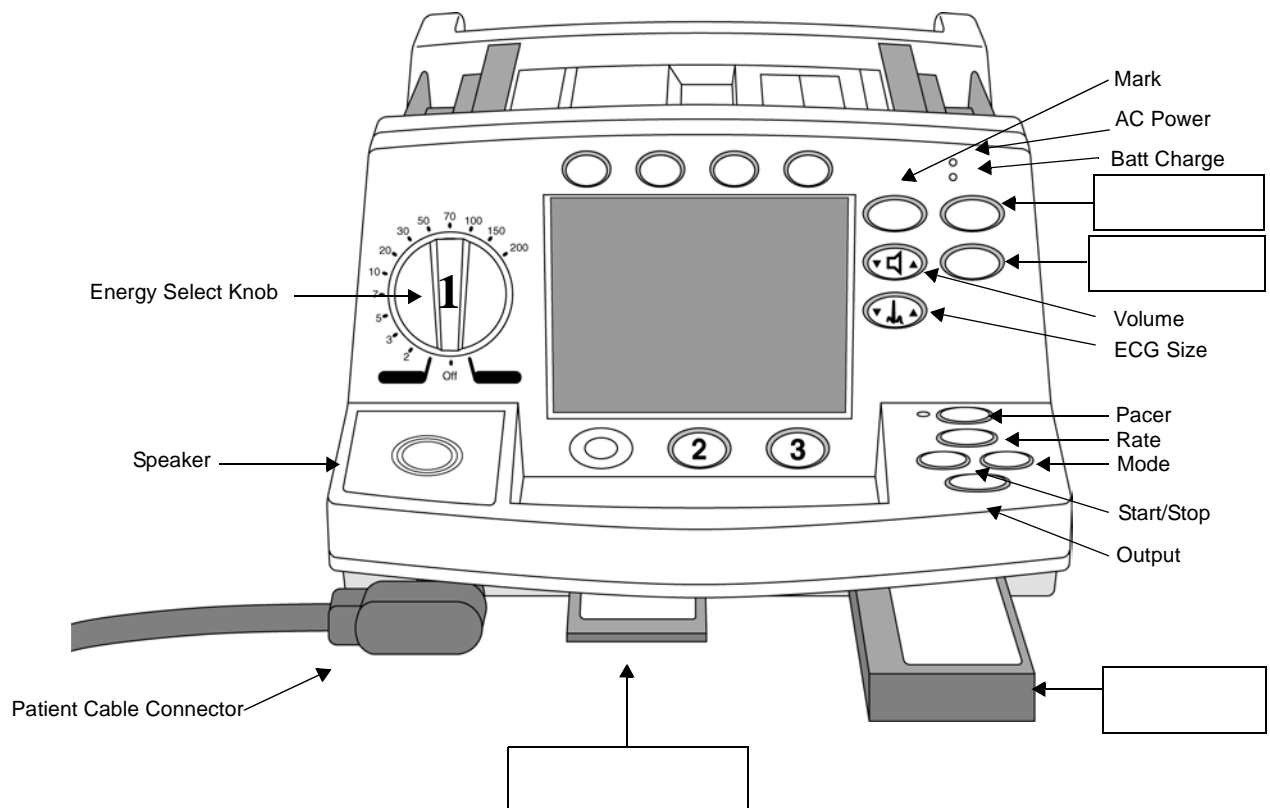
In Manual Mode, defibrillation is performed using multifunction defib electrode pads or paddles.

As in AED Mode, 3 lead or 5 lead ECG monitoring electrodes are used to monitor a patient's ECG in Manual Mode.

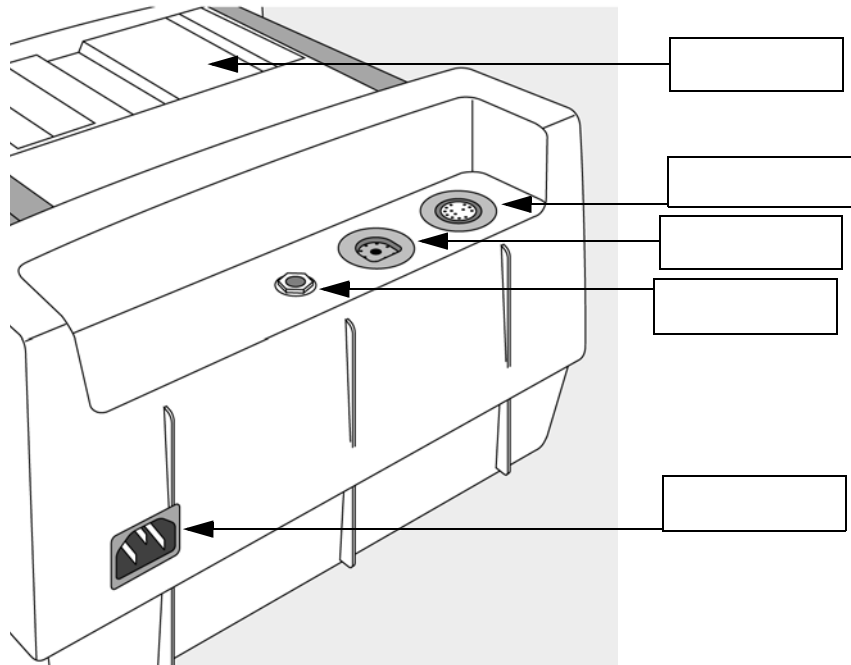
Review

1. What modes of operation are available with the HeartStart XL?

2. Label the missing controls on the HeartStart XL.



3. Identify the following components of the HeartStart XL.



Using SMART Biphasic

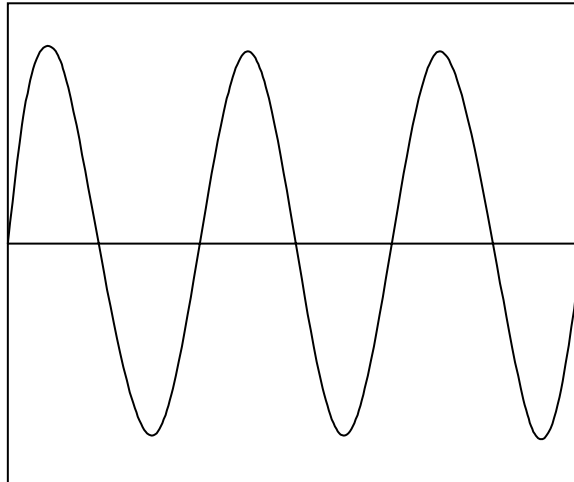
This topic explains the different types of waveforms used for defibrillation, including:

- Alternating Current Waveform
- Monophasic Damped Sine Waveform
- SMART Biphasic Waveform

Alternating Current

When defibrillators were just beginning to arrive in hospitals, they used alternating current (AC) waveforms. See Figure 2-3 below for an example of an AC waveform.

Figure 2-3 Alternating Current (AC) Waveform



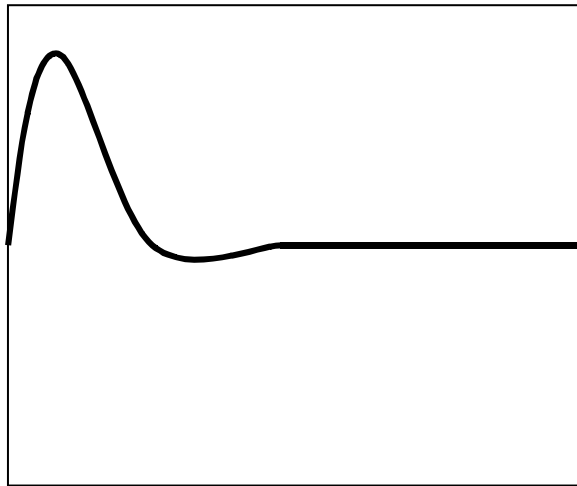
By today's standards, these defibrillators would not be considered very efficient. They were also associated with causing cardiac dysfunction to patients. Clinicians wanted a lighter, more effective device that utilized direct current (DC) waveforms.

Monophasic Damped Sine Waveform

Some manufacturers responded to clinicians' needs with defibrillators that used a type of DC Waveform known as the Monophasic Damped Sine. The Monophasic Truncated Exponential was used in early AEDs. Monophasic waveforms continue to be widely used in hospitals today. The maximum energy setting for the Monophasic Damped Sine is 360 joules.

See Figure 2-4 below for an example of a direct current waveform.

Figure 2-4 Direct Current (DC) Waveform



NOTE

Monophasic waveforms always assume that patient impedance is 50 ohms.

SMART Biphasic Waveform

The Biphasic Truncated Exponential waveform supports defibrillation at lower energies and is the standard waveform used in Implantable Cardioverter Defibrillators, or ICDs. SMART Biphasic waveforms result in smaller, lighter, more effectively designed defibrillators.

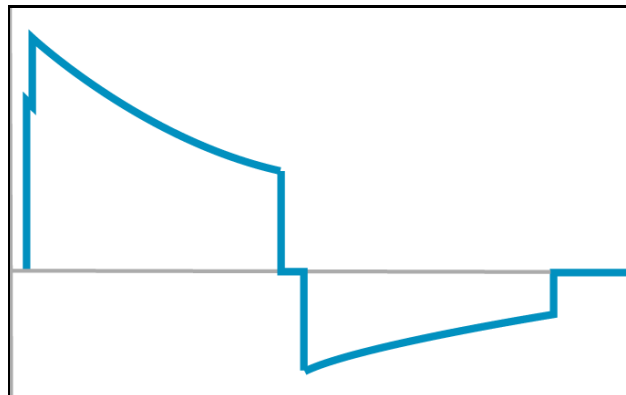
More importantly, SMART Biphasic Waveform technology has changed the way defibrillation therapy is delivered. A clinician using a monophasic defibrillator would typically shock a patient using escalating energy levels (200-300-360 joules). Conversely, a clinician operating a SMART Biphasic defibrillator would shock at the recommended 150 joules consistently (150-150-150 joules) if adult defibrillation is required. As a result, there is a decrease in myocardial dysfunction to the patient.

NOTE

Unlike the Monophasic Damped Sine Waveform, the SMART Biphasic Waveform measures the patient's impedance and adjusts the waveform accordingly prior to the delivery of each shock.

See Figure 2-5 for an example of the SMART Biphasic Waveform.

Figure 2-5 SMART Biphasic Waveform

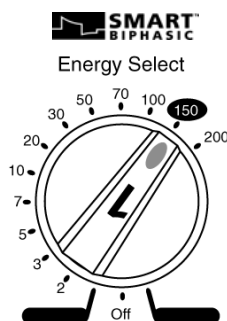


The change in energy levels recommended for defibrillation is a significant change for defibrillator operators.

You'll notice in Figure 2-6 that the rotary knob only goes up to 200 joules. No, we didn't forget to add the extra numbers!

Remember, when using SMART biphasic technology, the recommended shock sequence for an adult is 150-150-150, rather than the traditional 200-300-360.

Figure 2-6 M4735A HeartStart XL Rotary Knob at 150 Joules



NOTE

For more information about using SMART Biphasic Waveform Technology, please see the "Why is SMART Biphasic the Right Biphasic?" Application Note.

Review

1. Clinicians have used what 3 kinds of waveforms to defibrillate patient?
 - a.
 - b.
 - c.
2. What is the advantage of using SMART Biphasic Waveform Technology?
3. How does SMART Biphasic energy change how you defibrillate an adult patient?

Lesson Summary

- The HeartStart XL offers both AED and Manual Modes of operation.
- The HeartStart XL offers SMART Biphasic Waveform Technology for defibrillation therapy.

Lesson 3: Defibrillating in AED Mode

Lesson Objectives

After completing this lesson, you should be able to:

- Define AED Mode
- Determine when to use AED Mode
- Define the steps for AED defibrillation
- Identify elements of the AED Mode display

Lesson Topics

- Introducing AED Mode
- Indications for Use
- AED Display

Lesson Overview

This lesson will introduce you to the HeartStart XL's AED Mode, indications for AED Mode use, and the AED Mode display.

Introducing AED Mode

AED Mode is designed for BLS providers. It analyzes the patient's ECG and advises you whether or not to deliver a shock. Voice prompts guide you through the defibrillation process by providing instructions and patient information. Voice prompts are supported by text messages that appear on the display.

In AED Mode, you defibrillate using multifunction defib electrode pads. If monitoring a patient's ECG, you may also use 3 lead or 5 lead ECG monitoring electrodes.

In AED Mode, you can:

- perform Automated External Defibrillation (AED)
- perform ECG monitoring
- perform SpO₂ monitoring (optional)
- record when drugs are administered during an event
- print Event Summary documentation

The next topic will help you determine when the use of AED is appropriate. The last topic in this lesson will show you what steps to take if defibrillation is needed. But first, take a moment to answer the questions on the next page.

Review

1. In AED Mode, you can defibrillate a patient using which of the following equipment? (Check all that apply.)
 - a. multifunction defib electrode pads
 - b. 3 or 5 lead ECG
 - c. external paddles

2. AED Mode uses what kind of waveform?
 - a. SMART Biphasic
 - b. Monophasic

Indications for Use

AED Mode should be used when a patient is:

- Unresponsive
- Pulseless
- Not breathing

The quick reference card that arrived with your HeartStart XL will provide you with an easy way to determine whether defibrillation is necessary or not. Familiarize yourself with the card so that you will be prepared during an event.

NOTE

For more detailed information about indications for use for AED Mode, see your Instructions for Use.

Using AED Mode

This section discusses the three steps to defibrillation when in AED Mode. The three steps to this method are: 1. Turn to AED On, 2. Wait for the HeartStart XL to analyze the ECG, and 3. Shock.

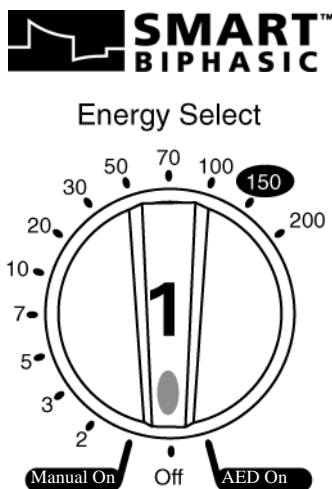
Read over the following section to learn about each step in detail.

NOTE

If you have a HeartStart XL and a simulator available, you may choose to perform these steps as you read along.

1. Power AED On

Turn the Rotary Knob to **AED On**.



2. HeartStart XL Analyzes ECG

The HeartStart XL automatically analyzes the patient's ECG on initial use. If you need to restart analysis during an event, simply press the button labeled "2". The HeartStart XL will always guide you through the defibrillation process via voice and text prompts.



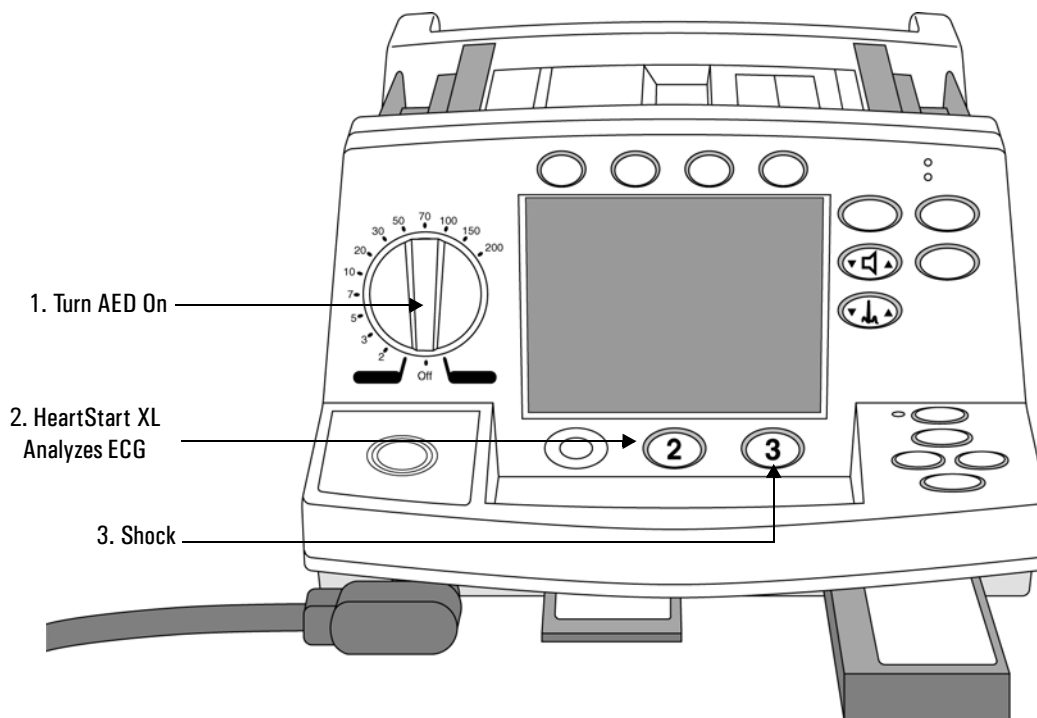
3. If Advised, Press Shock

To shock, simply call out clearly and loudly "Stand Clear!" and make sure no one is touching the patient. Then, press the shock button labeled "3".



See Figure 3-1 for the Energy Select knob, Analyze, and Shock buttons in AED Mode defibrillation.

Figure 3-1 AED Defibrillation



Review

1. You should prepare to defibrillate a patient in AED Mode if they are:

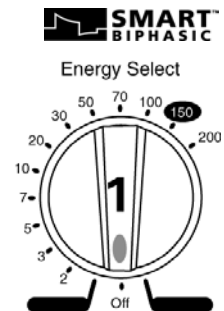
- _____
- _____
- _____

2. What are the three steps for defibrillation in AED Mode?

1. _____

2. _____

3. _____



2

3

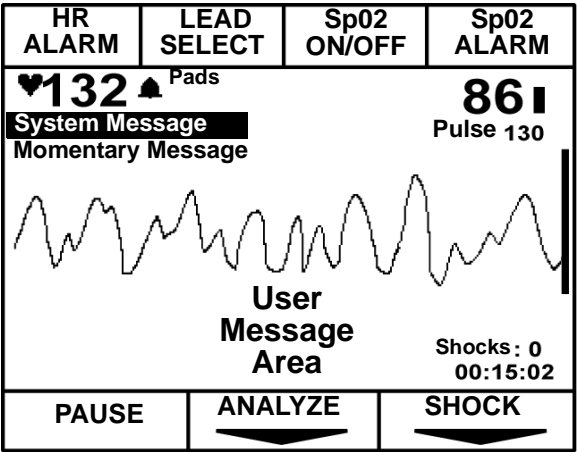
AED Display

This topic will identify the different elements that appear on the display in AED Mode. See Figure 3-2 for all of the possible information that may appear on the AED Mode display.

NOTE

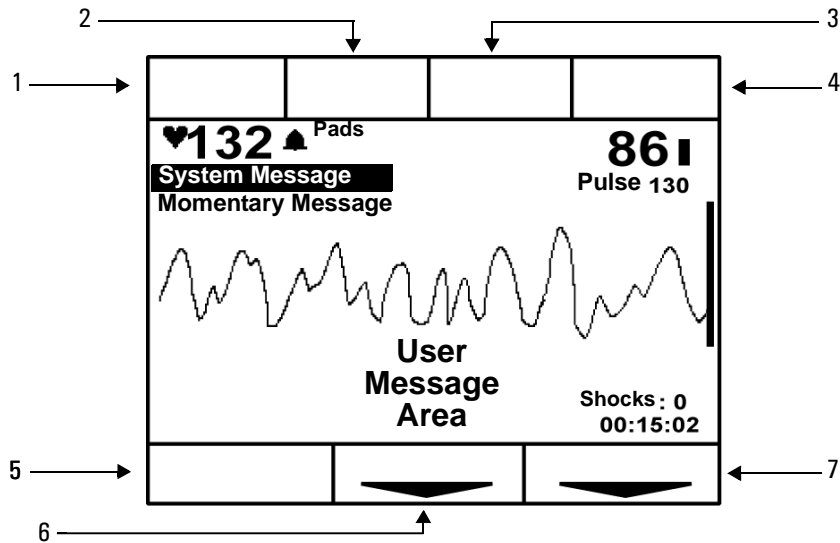
For detailed information about the AED display, please refer to your Instructions for Use.

Figure 3-2 AED Mode Display



Review

1. Identify the following 7 softkeys and write your answers below.



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

Lesson Summary

In this lesson you learned how to:

- Identify AED Mode
- Determine when to use AED Mode
- Define the steps for defibrillation in AED Mode
- Identify elements of the AED Mode display

Lesson 4: Defibrillating in Manual Mode

Lesson Objectives

After completing this lesson, you should be able to:

- Define Manual Mode
- Identify the Easy 1-2-3 Defibrillation method in Manual Mode
- Identify key features of performing synchronized cardioversion
- Define fixed and demand mode pacing

Lesson Topics

- Introducing Manual Mode
- Manual Mode Display
- Easy 1-2-3 Defibrillation in Manual Mode
- Synchronized Cardioversion
- Pacing (Optional)

Lesson Overview

This lesson will discuss the features available in Manual Mode including synchronized cardioversion and pacing.

Introducing Manual Mode

Manual Mode is designed for use by ALS providers to perform asynchronous defibrillation using either multifunction defib electrode pads or paddles.

To defibrillate in Manual Mode, you will need:

- HeartStart XL
- pads and pads patient cable (or paddles)
- data card (optional)
- fully charged battery (recommended)

Manual Mode differs from AED Mode defibrillation in that you are responsible for determining:

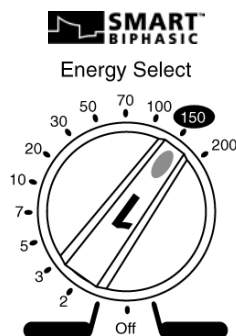
- if a shock is needed (assessing the patient's ECG)
- what energy level is used (you select your own energy level),
- when to charge the defibrillator,
- and when to deliver a shock.

Easy 1-2-3 Defibrillation in Manual Mode

This section discusses the three steps to Easy 1-2-3 Defibrillation when in Manual Mode. In this section, we will assume that we are using the recommended non-escalating SMART Biphasic energy level for an adult: 150 joules.

1. Select Energy

Turn the Rotary Knob to **the desired energy level**.



2. Charge

To charge the HeartStart XL, simply press the button labeled "2", if using pads or press the yellow charge button on the Apex paddle. Remember, the HeartStart will *not* guide you through the defibrillation process via voice and/or text prompts.



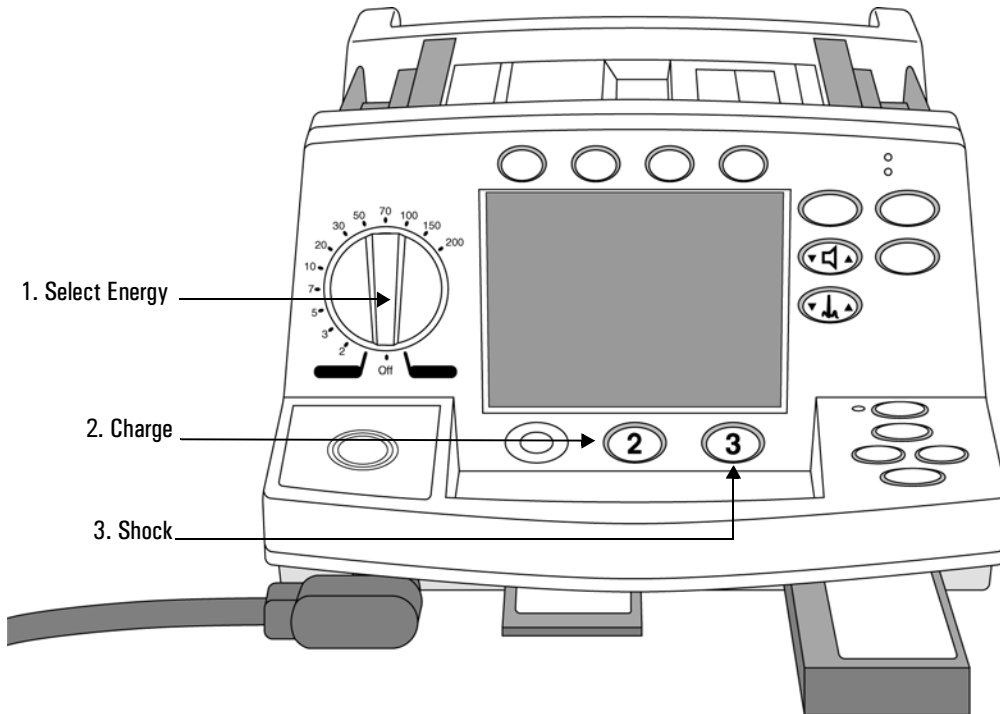
3. Shock

To deliver a shock, simply call out clearly and loudly "Stand Clear!" and make sure no one is touching the patient. Then, press the shock button labeled "3" if using pads, or press the orange shock buttons located on each paddle.



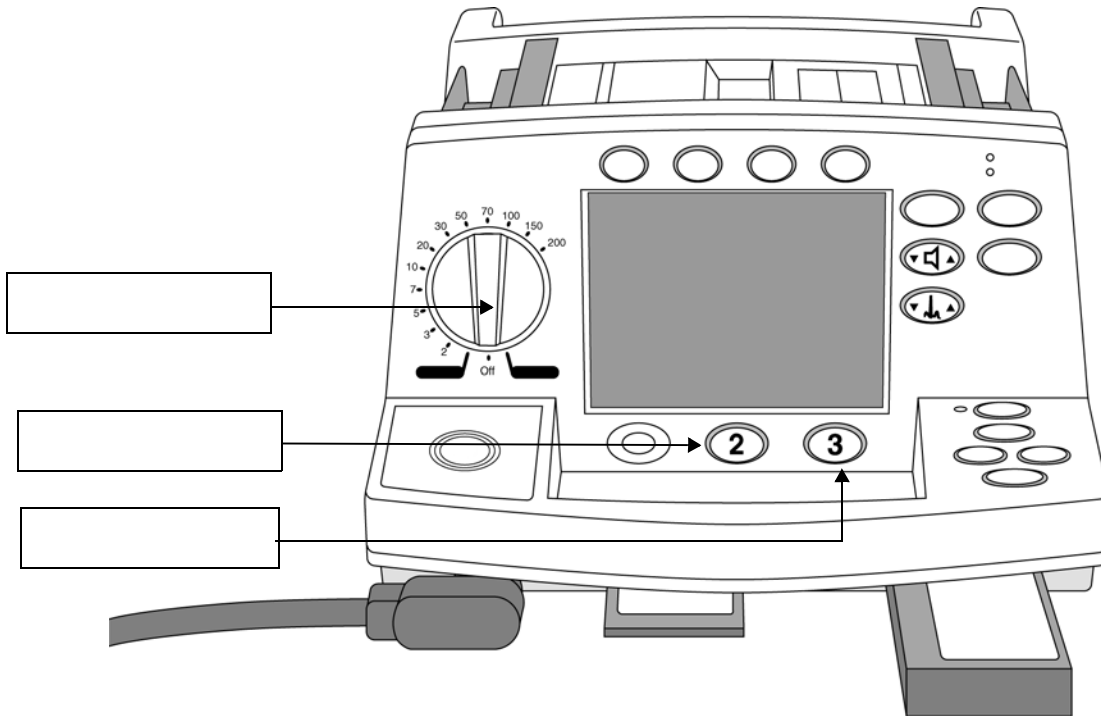
See Figure 4-1 for the location of the Energy Select knob and the charge and shock buttons on the HeartStart XL.

Figure 4-1 Easy 1-2-3 Defibrillation in Manual Mode



Review

1. Identify the steps for Easy 1-2-3 Defibrillation in Manual Mode below.

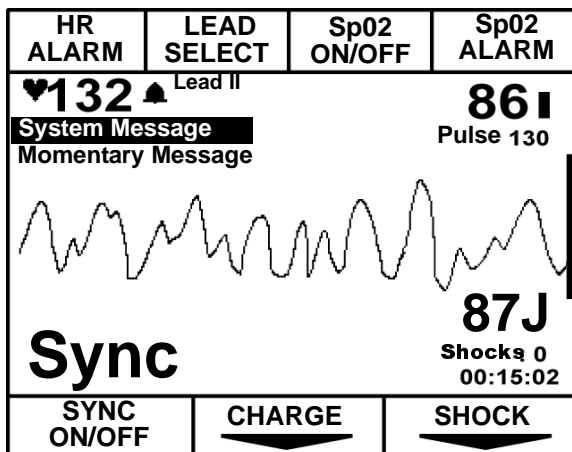


Manual Mode Display

The Manual Mode display differs somewhat from the AED Mode display that you learned about in Lesson 3. In Manual Mode, you will not receive text or audio prompts. Also, note that the softkeys on the bottom of the display vary from those found in AED Mode.

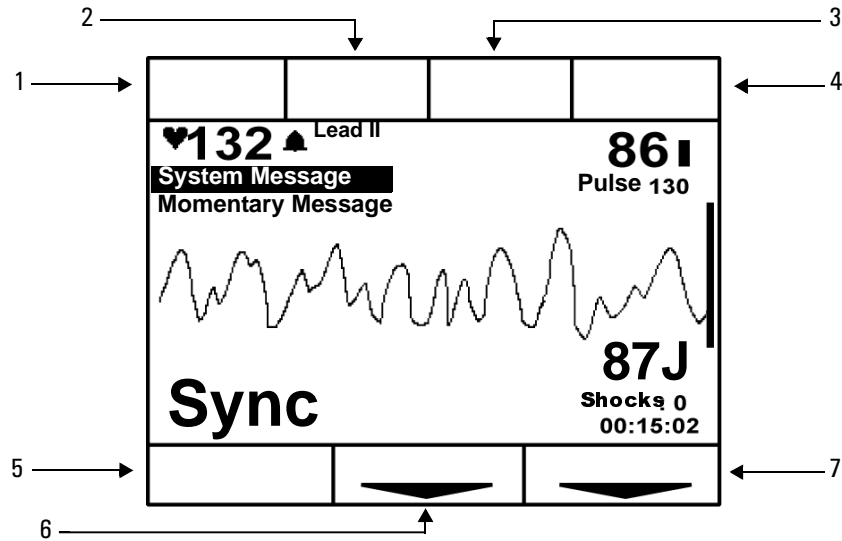
To compare these softkeys with those found in AED Mode, compare Figure 4-2 below to Figure 3-2: AED Mode Display on page 3-10 of this workbook.

Figure 4-2 Manual Mode Display



Review

1. Label the 7 softkeys below based upon the information shown on the display.



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

Synchronized Cardioversion

Definition

Synchronized cardioversion is a Manual Mode function that allows you to synchronize the defibrillator shock with the R-wave of the ECG you are monitoring.

Usage

You can monitor an ECG for synchronized cardioversion 4 different ways:

- multifunction defib electrode pads
- 3 or 5 lead monitoring electrodes
- external paddles
- external Hewlett-Packard, Agilent or Philips monitor (with the aid of a Sync cable)

NOTE

For detailed information about performing synchronized cardioversion, see Chapter 7 of your Instructions for Use.

Review

1. Synchronized Cardioversion is available in which mode?
 - a. AED Mode
 - b. Manual Mode
2. You can perform synchronized cardioversion using which of the following? (Check all that apply)
 - ☐ 3 or 5 ECG Electrodes
 - ☐ SpO₂ sensor
 - ☐ Multifunction defib electrode pads
 - ☐ Sync cable

Pacing (Optional)

This topic explains the location and function of pacing controls, including pacing in demand or fixed mode.

Definition

Noninvasive transcutaneous pacing is a Manual Mode function used to deliver paced pulses to the heart.

Usage

Paced pulses are delivered through multifunction defib electrode pads that are applied to the patient's bare chest.

You perform pacing using the following equipment:

- multifunction defib electrode pads
- 3 or 5 lead monitoring electrodes

NOTE

For detailed information about performing pacing, see Chapter 8 of your Instructions for Use.

Fixed v. Demand Mode

The HeartStart XL can deliver paced pulses in either demand or fixed mode.

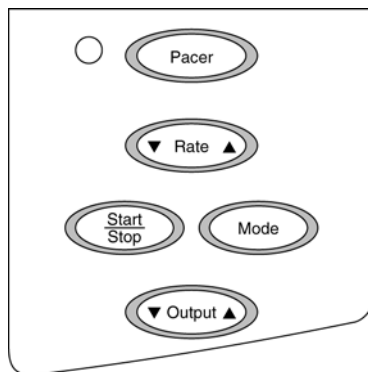
In *demand mode*, the pacer only delivers paced pulses when the patient's heart rate is lower than the selected pacing rate.

In *fixed mode*, the pacer delivers paced pulses at the selected rate.

Pacing Controls

The pacing controls are located on the right side of the HeartStart XL handle as shown in Figure 4-3.

Figure 4-3 Pacing Controls



Review

1. In demand mode, the pacer only delivers paced pulses when the patient's heart rate is lower than the selected pacing rate.
 - a. False, this occurs in fixed mode.
 - b. True

Lesson Summary

In this lesson you learned how to:

- Define Manual Mode
- Identify the Easy 1-2-3 Defibrillation method in Manual Mode
- Identify key features of performing synchronized cardioversion
- Define pacing in fixed mode and demand mode

Lesson 5: ECG Monitoring

Lesson Objectives

After completing this lesson, you should be able to:

- Change lead selection on the HeartStart XL
- Locate the Heart Rate Alarm settings on the display

Lesson Topics

- Selecting a Lead
- Heart Rate Alarms

Lesson Overview

This lesson will teach you how to select the correct lead and change heart rate alarms when monitoring the ECG using the HeartStart XL.

Selecting a Lead

Proper application and placement of electrodes is essential for reliable monitoring results. Good contact between the electrode and the skin reduces the effects of motion artifact and signal interference.

NOTE

For a complete explanation of Electrode Placement, see Chapter 4 in your Instructions for Use.

Lead Select Choices

Depending upon how your HeartStart XL is configured, you will have different choices as you select a lead.

3 Lead (Standard)

For example, if your HeartStart XL is configured for a 3 lead ECG patient cable you will have the following lead select choices:

- Paddles
- Pads
- Lead I
- Lead II
- Lead III

5 Lead (Optional)

If your HeartStart XL is configured to use a 5 lead, you will have 4 additional lead choices:

- Lead aVR
- aVL
- aVF
- V lead

Skin Preparation

Before applying electrodes, be sure to prepare a patient's skin properly by performing the following simple steps:

1. Shave/clip hair at electrode sites, if necessary.
2. Clean and abrade the skin at the electrode sites.
3. Dry the skin.

Review

1. Which of the following lead selection choices are available *only* with a 5 lead?
 - ☐ V lead
 - ☐ Lead III
 - ☐ Lead aVR
 - ☐ Lead II

2. What steps should you take to prepare the patient's skin for electrode placement?

1. _____

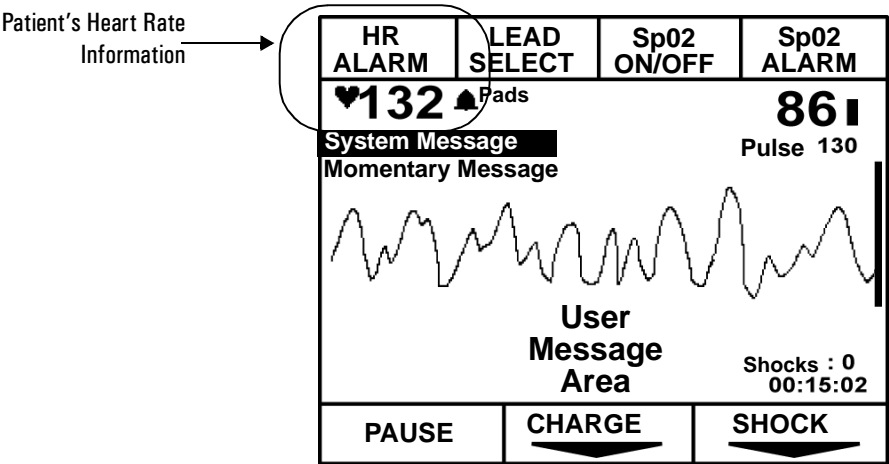
2. _____

3. _____

Heart Rate Alarms

Heart rate alarms may be configured to alert you when the heart rate is outside of specified limits. You will find the Heart Rate Alarm icon (♥) on the display to the left of the numerical heart rate and below the HR ALARM softkey. To the right of the numeric heart rate, the bell icon (🔔) indicates that the alarm limit has been set.

Figure 5-1 Heart Rate Alarm Display



Heart Rate Alarm Ranges

The Hearstream XL provides several heart rate alarm ranges to choose from:

- 30 - 100
- 60 - 140
- 90 - 160
- 120 - 200

Setting the Heart Rate Alarm

To set the heart rate alarm, cycle through the choices by pressing the button above the HR ALARM softkey on the display. Stop when you see the desired range. The heart icon will then appear next to the heart rate value.

Review

1. What button do you push on the HeartStart XL to set the heart rate alarm?

Lesson Summary

In this lesson you learned how to:

- Change lead selection on the HeartStart XL
- Locate the Heart Rate Alarm settings on the display

Lesson 6: SpO₂ Monitoring (Optional)

Lesson Objectives

After completing this lesson, you should be able to:

- Define SpO₂
- Change SpO₂ Alarm Limits
- Identify SpO₂ readings

Lesson Topics

- Understanding Pulse Oximetry
- SpO₂ Alarms
- SpO₂ Display Information

Lesson Overview

This lesson will teach you how to perform SpO₂ Monitoring, set SpO₂ alarms and identify SpO₂ data on the display.

Understanding Pulse Oximetry

Definition

Pulse oximetry is a noninvasive method of continuously measuring oxygen saturation (SpO_2) in arterial blood. The SpO_2 reading indicates the percentage of hemoglobin molecules in the arterial blood which are saturated with oxygen.

Usage

SpO_2 monitoring is one of the best tools available to assist in assessing a patient's cardiac and respiratory systems.

The HeartStart XL's SpO_2 features are available in AED and Manual Mode.

NOTE

SpO_2 is an *optional* feature available with the HeartStart XL.

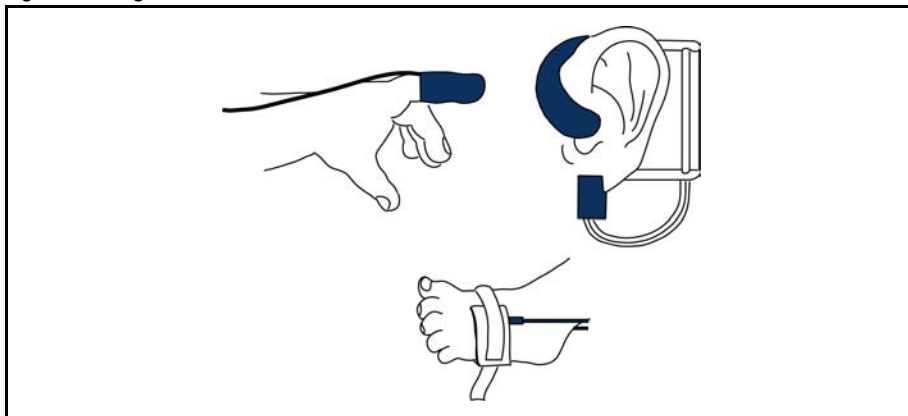
To obtain an SpO_2 reading you will need:

- HeartStart XL with SpO_2 capabilities
- Pulse oximetry sensor

Sensors may be applied to the following parts of the body (see Figure 6-1):

- Finger
- Ear
- Foot

Figure 6-1 Finger, Ear and Foot Sensors



NOTE

For detailed information about pulse oximetry see the SpO₂ Monitoring Application Note.

NOTE

For detailed information about applying sensors and connecting the SpO₂ cable, see Chapter 5 in your Instructions for Use.

Review

1. Sensors may be applied to which parts of a patient's body?
 - a.
 - b.
 - c.

2. An SpO₂ reading indicates the percentage of _____ molecules in the arterial blood which are saturated with _____.

SpO₂ Alarms

SpO₂ Alarm Limits

The HeartStart XL provides the following lower SpO₂ alarm limits:

- 80
- 85
- 90

The **high limit** is set at **100** and may not be changed.

Setting the SpO₂ Alarm

To set SpO₂ alarms to alert you when the SpO₂ reading falls below a specified lower limit, repeatedly press the button above the SpO₂ ALARM softkey on the display. When you reach the desired level, stop.

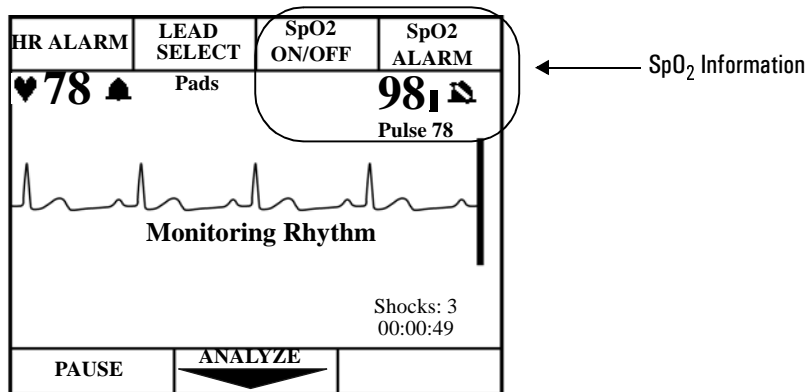
Review

1. The high limit of the SpO₂ alarm is _____.
2. To change SpO₂ alarm limits, press the _____ button on the display.

SpO₂ Display Information

SpO₂ information is displayed on the upper right hand side of the HeartStart XL display.

Figure 6-2 HeartStart XL SpO₂ Display in AED Mode



Review

1. SpO₂ is available as an _____ in both _____ and _____ Modes.
2. To activate the SpO₂ Alarm softkey, press the button above the _____ softkey.

Lesson Summary

In this lesson, you learned how to:

- Define the SpO₂
- Change SpO₂ Alarm Limits
- Identify SpO₂ readings on the HeartStart XL display

Lesson 7: Printing Strips

Lesson Objectives

After completing this lesson, you should be able to:

- Identify how to print a strip
- Identify how to print an event summary
- Identify how to mark a strip

Lesson Topics

- Introducing Strips
- Printing Strips and Event Summaries
- Marking Strips

Lesson Overview

This lesson will teach you how to document an event, generate an event summary, and mark a strip.

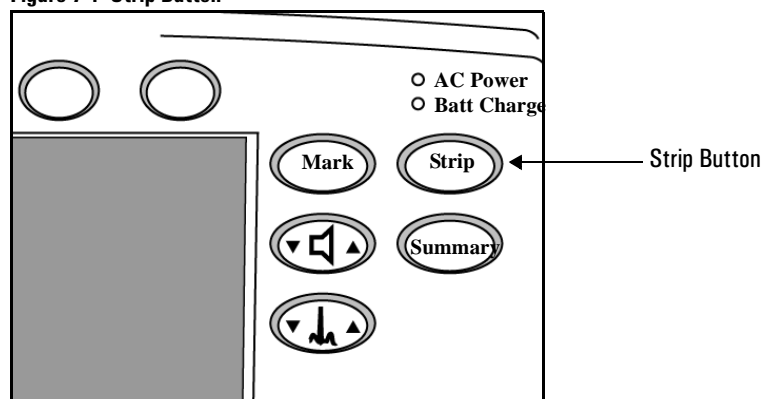
Introducing Strips

The HeartStart XL generates a patient record of each event known as an Event Summary. The Event Summary is stored on the HeartStart XL and is available for retrieval and printing after an event occurs until the beginning of the next event.

The HeartStart XL also provides the option of printing individual events as they occur or marking specific events to be included in the Event Summary.

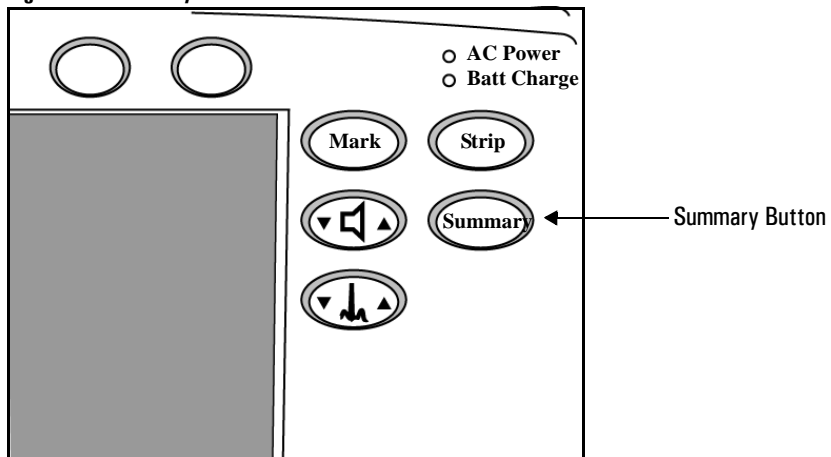
To obtain a strip at any time during an event, press the Strip button on the right side of the display as shown in Figure 7-1. The strip will print continuously. To stop printing, simply press the Strip button again.

Figure 7-1 Strip Button



To print an event summary, press the summary button. The event summary printout will stop automatically when it is complete.

Figure 7-2 Summary Button



An event summary provides you with the following information (see Figure 7-3) :

- Space for the patient and the operator’s name to be written
- a list of events that occurred during the incident and when they occurred
- the energy level used
- ECG strips of the events documented in the above list

Figure 7-3 Event Summary

Patient								Device On				09:18:00	
								AED Mode				09:18:00	
Operator								Pads On				09:18:01	
								Leads On				09:18:03	
Device On				03 Nov 00			09:18:00	Analyzing				09:18:03	
								Shock Advised				09:18:11	
Last Event				03 Nov 00			10:09:04	Shock #1				09:18:17	
								Analyzing				09:18:24	
Total Shocks				2				Shock Advised				09:18:31	
Incident:				0000055				Shock #2				09:18:38	
Serial Number				123456789				Manual Mode				09:18:42	

Review

- 1. What is the difference between documentation generated by pressing the Strip button versus documentation generated by pressing the Summary button?
- 2. Review the following Event Summary and answer the questions below.

Patient										Device On						12:41:00		
										AED Mode						12:41:00		
Operator										Pads On						12:41:02		
										Analyzing						12:41:23		
Device On				03 Sep 00						Shock #1						12:41:26		
										Device Off						12:41:31		
Last Event				03 Sep 00						Continued Use						12:41:34		
										Manual Mode						12:41:42		
Total Shocks				2						Shock #2						12:41:45		
Incident:				0000045														
Serial Number				123456789														

- a. How many shocks were delivered to this patient?
- b. When did the operator enter Manual Mode?
- c. Did the operator use paddles or pads?

Marking Strips

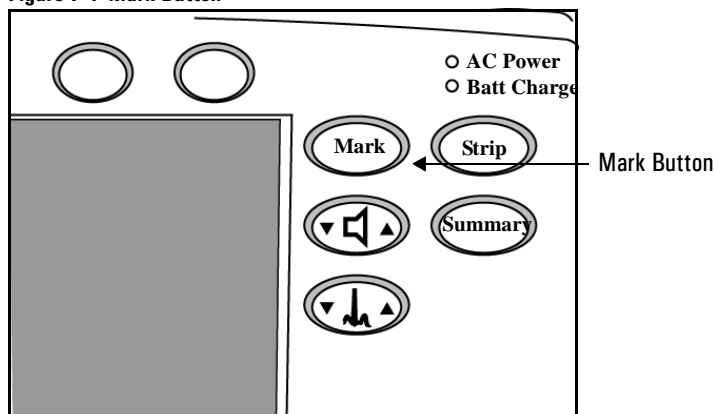
Definition

Marking a strip annotates a specific moment or action during an event. This annotation is stored both on the Data Card (optional) and in the internal Event Summary. The Mark button is active in both Manual Mode and AED Mode (if configured on).

Usage

To Mark a strip, simply press the Mark button as shown in Figure 7-4.

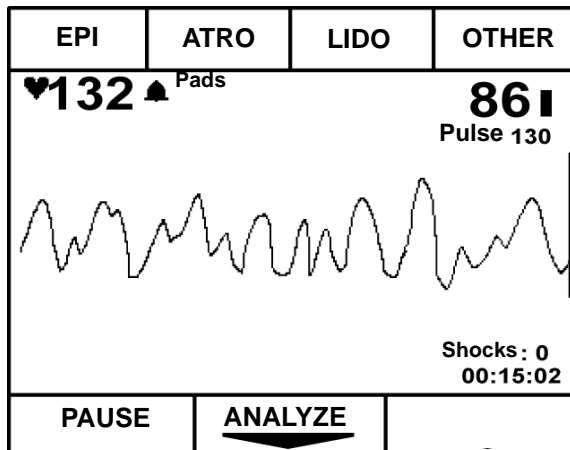
Figure 7-4 Mark Button



Pressing Mark does two things:

- Marking an event annotates the strip with a black triangle. This indicates the point at which the Mark button was pressed.
- Pressing the Mark button also triggers the display of four softkeys: EPI, ATRO, LIDO, and Other (Figure 7-5).

Figure 7-5 Mark Options

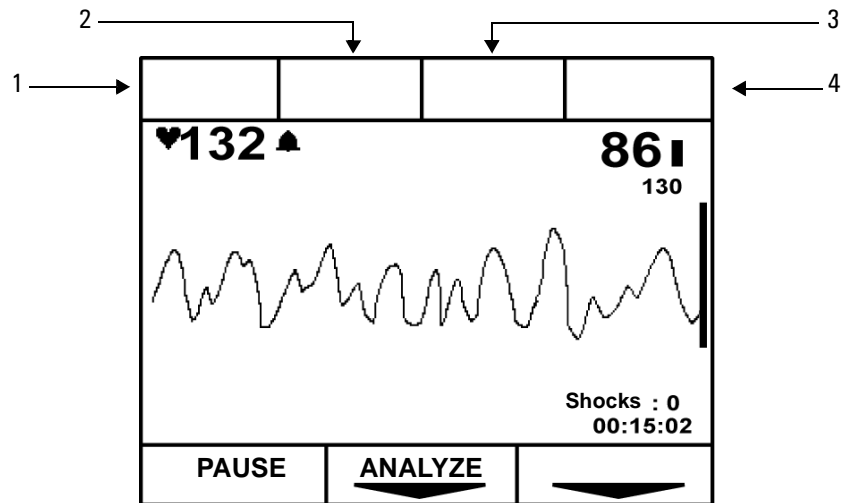


Once these medications are displayed, simply press the appropriate button within 5 seconds to indicate when medication is being administered.

Once you press a button, the corresponding annotation is made on the strip and the softkeys disappear.

Review

1. The _____ button annotates the time at which a particular action or event was documented during an event.
2. What softkeys appear on the top of HeartStart XL display after the Mark button is pressed?
3. Identify the 4 softkeys shown below. (*Hint: These softkeys appear after the Mark button has been pressed.*)



1. _____
2. _____
3. _____
4. _____

Lesson Summary

In this lesson you learned how to:

- Identify how to print a strip
- Identify how to print an event summary
- Identify how to mark a strip

Lesson 8: Unit Care

Lesson Objectives

After completing this lesson, you should be able to:

- Perform a Shift/System Check
- Identify best practices for battery maintenance
- Identify best practices for cleaning the HeartStart XL

Lesson Topics

- Performing a Shift/System Check
- Battery Maintenance
- Cleaning the HeartStart XL

Lesson Overview

This lesson will teach you how to perform a Shift/System Check, maintain your batteries, and properly care for your HeartStart XL.

Performing Shift/System Checks

Performing routine Shift/System Checks is an important part of determining the viability of your HeartStart XL and ensuring the defibrillator/monitor will be ready when you need it.

Documentation produced during a Shift/System Check records the date and time and date of the current check as well as the previous check. The model number, serial number, and operator check list also appear on the strip as shown in Figure 8-1.

Figure 8-1 Shift/System Check Report Using External Paddles

Shift/System Check	8 Jan 1999 13:52:17	M4735A Serial Number:00000001
Last Checked 25 Nov 00	1:25:30 Pass	Qty/Check List:
Current Tests:	Pass	
General System Test:	Pass	___ Defibrillator Inspection
ECG Test:	Pass	___ Cables/Connectors
Backup Power Test:	Pass	___ Paddles/Pads
SpO2 Test:	Pass	___ Monitoring Electrodes
Data Card Test:	2:07 (h:mm remaining)	___ Charged Batteries
Defib Test:	Pass/External Paddles	___ AC Power Cord
Pacer Test:	Not tested	___ Printer Paper
		___ Data Card
		___ Ancillary Supplies
		___ SpO2 Sensor

To perform a Shift/System Check follow the 7 steps below.

1. Turn the HeartStart XL off.
2. If the Data Card is routinely used, insert it into the HeartStart XL.
3. Unplug the AC power cord (power must be disconnected to properly test the battery.)
4. Verify a charged battery is in the HeartStart XL.
5. Press and hold the Strip button, then turn the Energy Select knob to Manual On.
6. Conduct the test by following the prompts shown on the display.
7. Review the report that is printed when the test is complete.

Review

1. When performing a Shift/System Check, you should:
(Check all that apply.)
 - ☐ Connect the HeartStart XL to AC power
 - ☐ Insert a data card, if used routinely
 - ☐ Set the Energy Select knob to 150 joules
 - ☐ Press and hold the Strip button, then turn the Energy Select knob to Manual On, to begin the check

Battery Maintenance

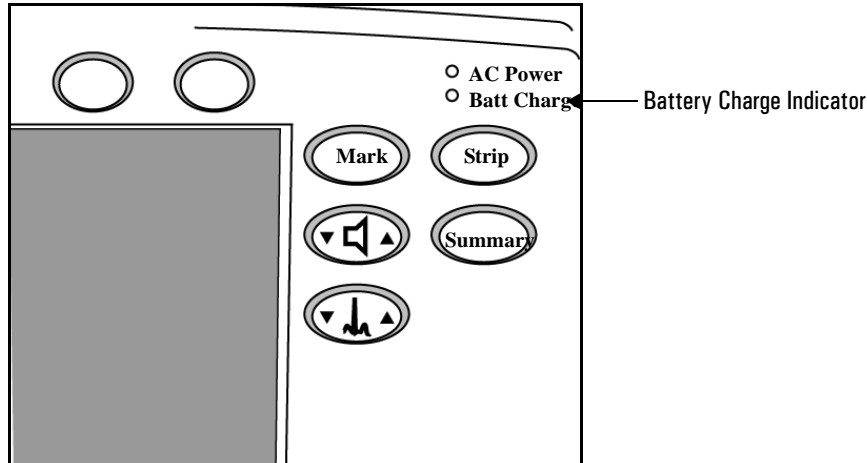
The HeartStart XL runs on both AC and battery power.

In this topic, you will learn how to ensure that the batteries used with the HeartStart XL are properly maintained and ready for use when AC power is unavailable.

Battery Capacity

When the HeartStart XL is running on AC power and a battery is installed, the Battery Charge indicator illuminates.

Figure 8-2 Battery Charge Indicator



If the light is *green*, the battery is charged from 90 to 100% of capacity.

If the light is *amber*, the battery is charged to less than 90% of capacity.

Charging Batteries

It will take approximately 3 hours to charge a battery to 90% of capacity.

It will take approximately 12 hours to charge a battery to 100% of capacity.

A new, fully charged battery can provide 100 minutes of monitoring time, or more than 50 charge-shock cycles at 200 joules.

Life Expectancy

Life expectancy of your batteries depends upon the frequency and duration of use as well as level of maintenance. If properly cared for, your batteries will last approximately 2 years.

NOTE

For detailed information about proper battery storage and care, read the Battery Maintenance Application Note that arrived with your HeartStart XL Defibrillator/Monitor.

- To ensure you get the most out of your batteries, you should:
- Perform visual inspections
 - Charge batteries after each use
 - Store the battery properly (See your Instructions for Use for details)
 - Perform a battery capacity test periodically, as appropriate for your institution’s usage (see table below)

Perform a Battery Capacity Test	Average Usage
Every 6 months	Infrequent use for short duration*
Every 3 months	Frequent use, or for longer duration

* “Infrequent use” is less than once per day. “Short duration” is ≤ 15 shocks, or ≤ 30 minutes of monitoring, or ≤ 6 shocks and 20 minutes of monitoring.

Review

1. For a HeartStart XL that is used infrequently for short duration, battery capacity tests should be performed
 - weekly
 - every 6 months
 - annually
 - every 3 months

2. A new, fully charged battery can provide _____ minutes of ECG monitoring time or _____ charge-shock cycles at 200 joules.

Cleaning the HeartStart XL

Recommended cleaning solutions for the HeartStart XL, battery, and data card are:

- Isopropyl alcohol
- mild soap and water
- chlorine bleach
- quaternary ammonium compounds, such as Lysol

NOTE

The HeartStart XL *cannot* be autoclaved, ultrasonically cleaned, or immersed. Abrasive cleaners and strong solvents should *not* be used on the HeartStart XL.

Also, don't pour fluids directly onto the device or allow them to penetrate exterior surfaces. Finally, a soft cloth is recommended when cleaning the HeartStart XL.

Review

1. Cleaning materials recommended for the HeartStart XL, battery and optional data card include:
 - ❑ chlorine bleach
 - ❑ steam cleaners
 - ❑ alcohol
 - ❑ ultrasonic cleansers

Lesson Summary

In this lesson, you learned how to:

- Perform a Shift/System Check
- Identify best practices for battery maintenance
- Identify best practices for cleaning the HeartStart XL

Review Answers

Lesson 2

Page 2-6

1. AED Mode, Manual Mode
2. *(Clockwise)* Strip button, Event Summary button, Battery, Data Card
3. *(From the top)* Printer, ECG In Connector, SpO2 Connector, ECG Out Connector, AC Power.

Page 2-13

1. a: AC Current, b: Monophasic Damped Sine, c: SMART Biphasic
2. Lower energy levels result in a decrease in myocardial dysfunction to the patient.
3. The recommended shock sequence is non-escalating at 150-150-150 joules, unlike the monophasic escalating sequence of 200-300-360.

Lesson 3

Page 3-4

1. a: multifunction defib electrode pads
2. a: SMART Biphasic

Page 3-9

1. unresponsive, pulseless, not breathing
2. 1 - Turn AED On, 2 - Wait for Analysis, 3- Shock

Page 3-11

1.
 1. HR Alarm
 2. Lead Select
 3. SpO2 On/Off
 4. SpO2 Alarm
 5. Pause
 6. Analyze
 7. Shock

Lesson 4

Page 4-7

1. *(From top to bottom)* Select Energy, Charge, Shock

Page 4-9

1.
 1. HR Alarm
 2. Lead Select
 3. SpO2 On/Off
 4. SpO2 Alarm
 5. Sync On/Off
 6. Charge
 7. Shock

Page 4-11

1. b: Manual Mode
2. 3 or 5 ECG electrodes, Multifunction defib electrode pads, Sync cable

Page 4-14

1. b: True

Lesson 5

Page 5-5

1. V lead, Lead aVR
2. Steps for Skin Prep:
 1. Shave/clip hair at electrode sites.
 2. Clean and abrade the skin at the electrode sites.
 3. Dry the skin.

Page 5-8

1. HR Alarm softkey

Lesson 6

Page 6-5

1. a: finger, b: ear, c: foot
2. hemoglobin, oxygen

Page 6-7

1. 100
2. SpO2 Alarm button

Page 6-9

1. option, AED and Manual
2. SpO₂ Alarm

Lesson 7

Page 7-6

1. A strip documents events as they occur during an event. An Event Summary provides a detailed account of all of the happenings that occurred during an event.
2.
 - a. 2
 - b. 12:41:42
 - c. pads

Page 7- 9

1. Mark
2.
 - a. EPI = Epinephrine
 - b. ATRO = Atropine
 - c. LIDO = Lidocaine
 - d. Other
3.
 1. EPI
 2. ATRO
 3. LIDO
 4. OTHER

Lesson 8

Page 8-5

1.
 - ☐ Insert a data card, if used routinely
 - ☐ Press and hold the Strip button, then turn the Energy Select knob to Manual On, to begin the check

Page 8-8

1. Every 6 months
2. 100 minutes, 50 charge-shock cycles

Page 8-10

1.
 - ☐ chlorine bleach
 - ☐ alcohol

PHILIPS

HEARTSTART XL

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